Framework for CAD/CAM/PDM Applications

the Synergy of STEP and Java™ Technology

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Topics

- Basic Facts on SDAI - Overview
- J-SDAI extensions
  - JSdaiServer
  - Mapping extension
  - 3D-Viewer
  - PDM-Bean
- J-SDAI CAD/CAM/PDM Applications (prototypes)
  - AP203Book
  - JMID-3D
  - AP210 viewer

Basic facts on SDAI

1 Standard Data Access Interface to ISO 10303 data representations (schema population, exchange structure)

2 SDAI defined a **low level API** to work on any EXPRESS data such as STEP, PLIB, Oil&Gas, STEP-NC ...
It is a stable **fundament for higher level operations**.

3 SDAI (ISO 10303-22) is platform and language neutral.
Language bindings: C++ (-23), C (-24),
complete Java (-27), lightweight Java (-29)

4 The available operation are very similar to EXPRESS.

5 Conformance Testing Methodology and Framework: Abstract Test Methods for SDAI Implementations (-35)

Basic facts on SDAI

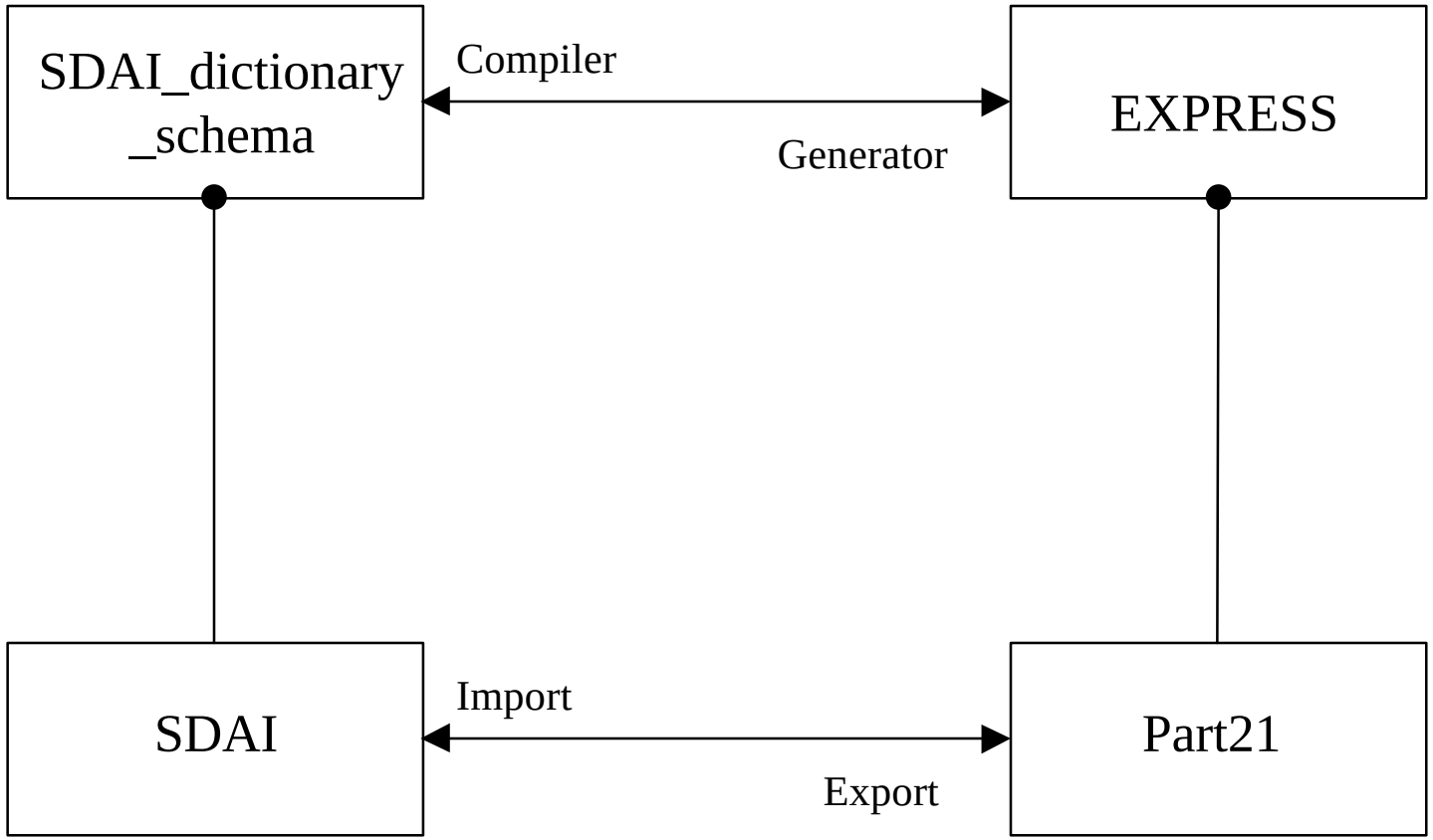
6 SDAI can operate on application data and on meta-level data (SDAI_dictionary_schema)

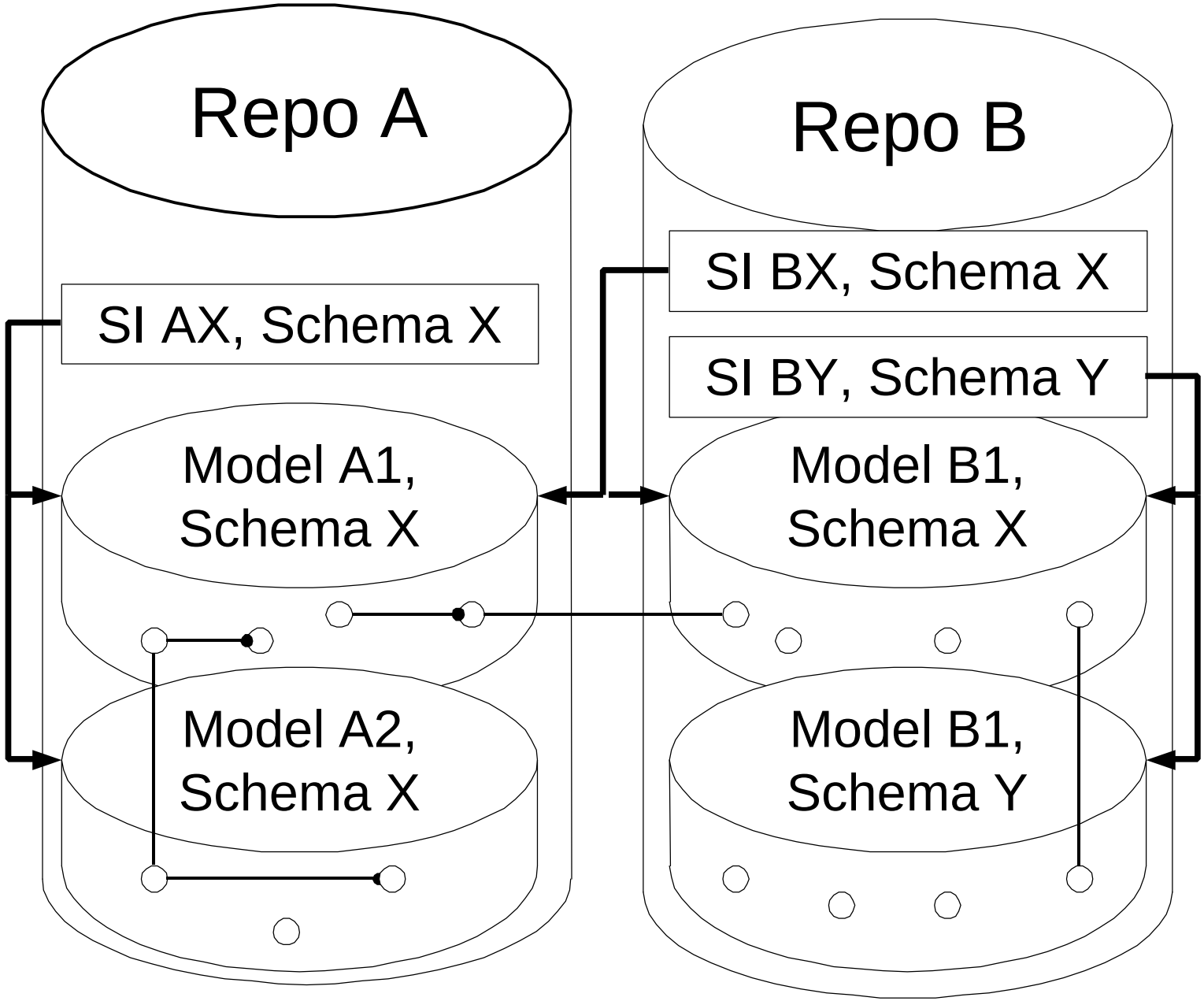
7 Operations on entities, attributes and aggregates:
late binding: Type identified by parameter
early binding: Type is defined my class and method

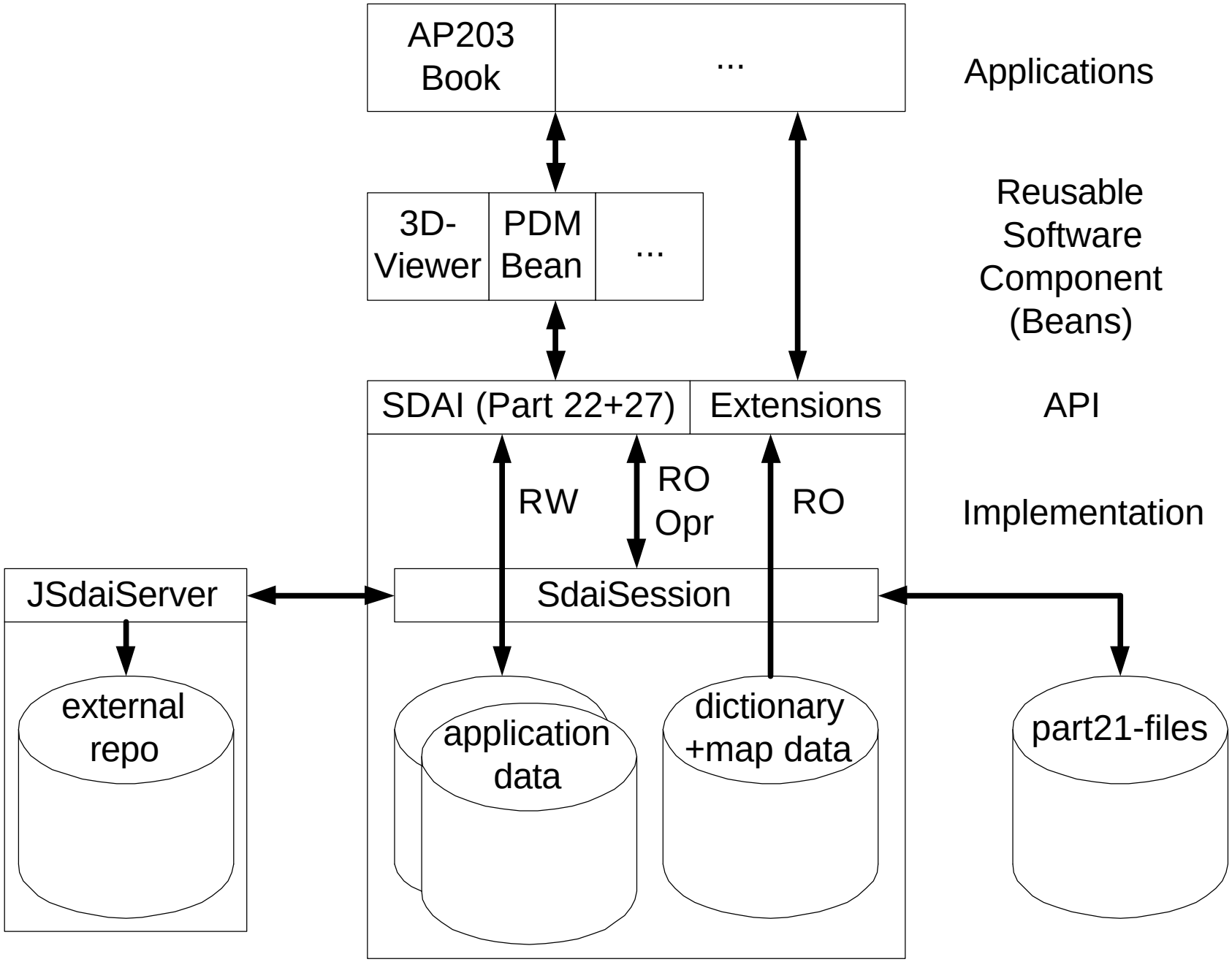
8 SDAI cover (almost) all data from part21 files and even more (validation, external references)

9 In EXPRESS entity instances simply exist. Nothing is stated where they exist. SDAI defines containers holding entity instance populations:
SdaiRepository, SchemaInstance, SdaiModel

Dependencies of the STEP Description and Implementation Methods

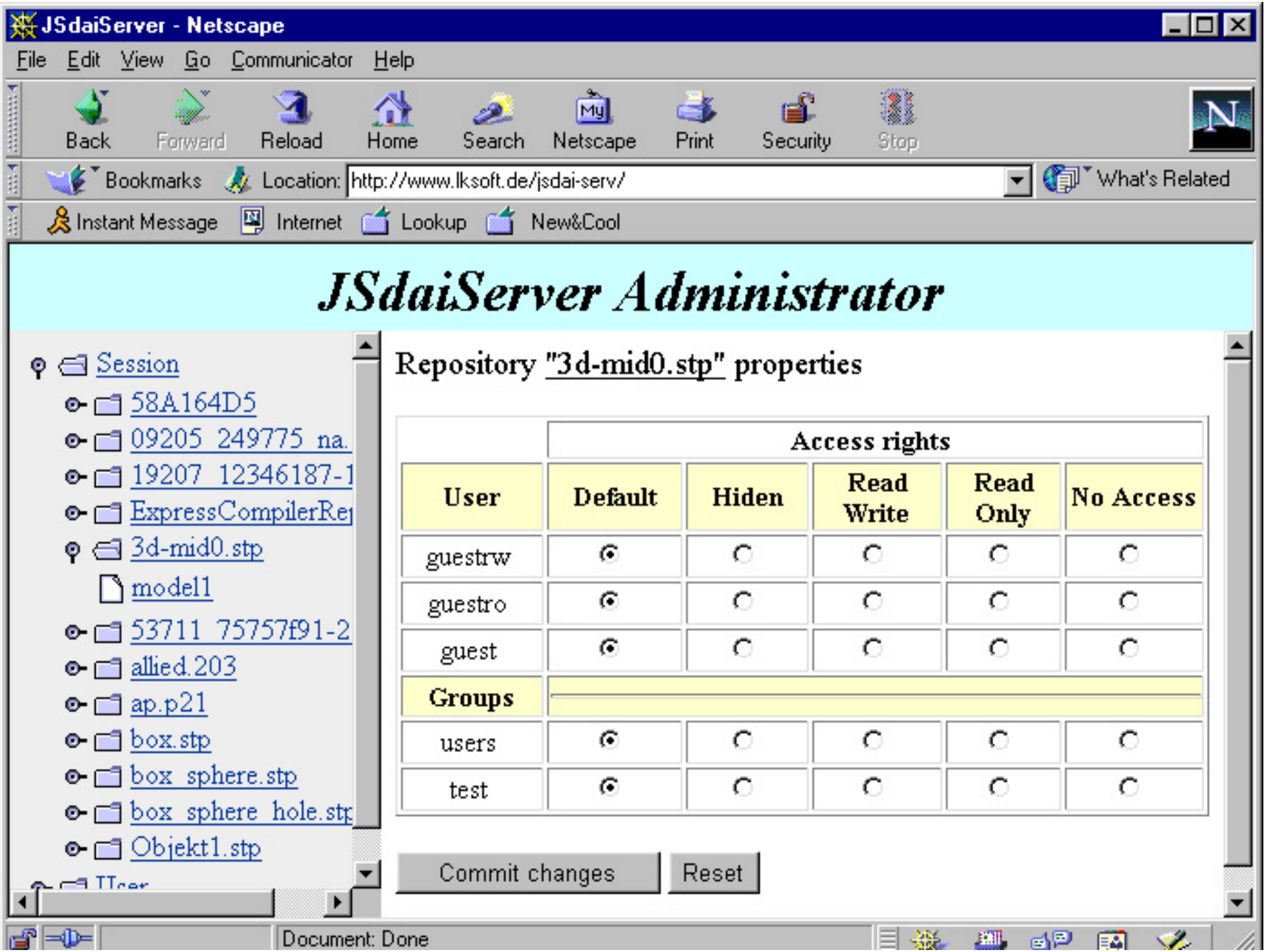


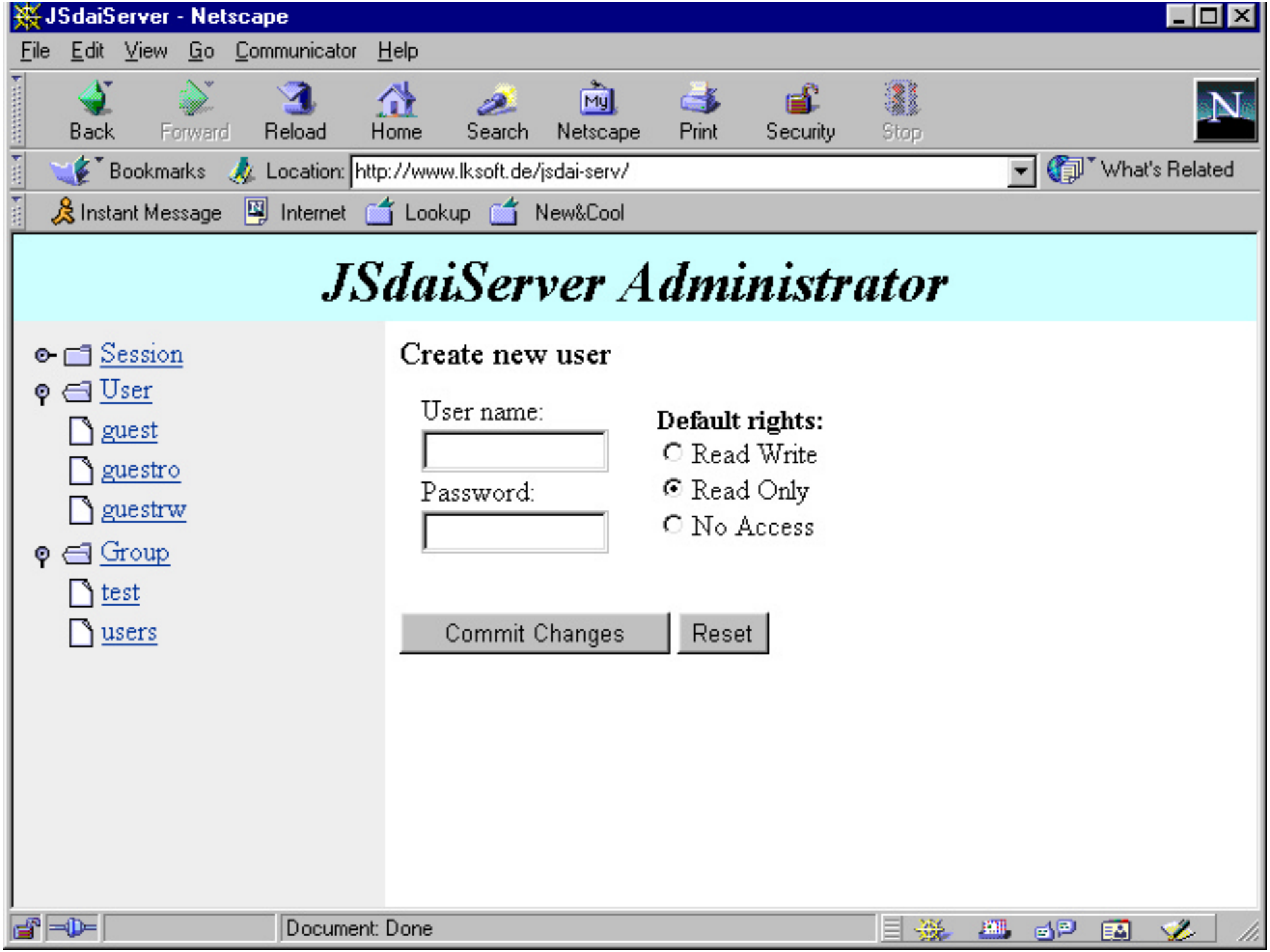

Repo A
Repo B
SI AX, Schema X
SI BX, Schema X
SI BY, Schema Y
Model A1, Schema X
Model B1, Schema X
Model A2, Schema X
Model B1, Schema Y


AP203
Book
...
Applications
3D-
Viewer
PDM
Bean
...
Reusable
Software
Component
(Beans)
SDAI (Part 22+27)
Extensions
API
RW
RO
Opr
RO
Implementation
JSdaiServer
SdaiSession
external
repo
application
data
dictionary
+map data
part21-files

JSdaiServer

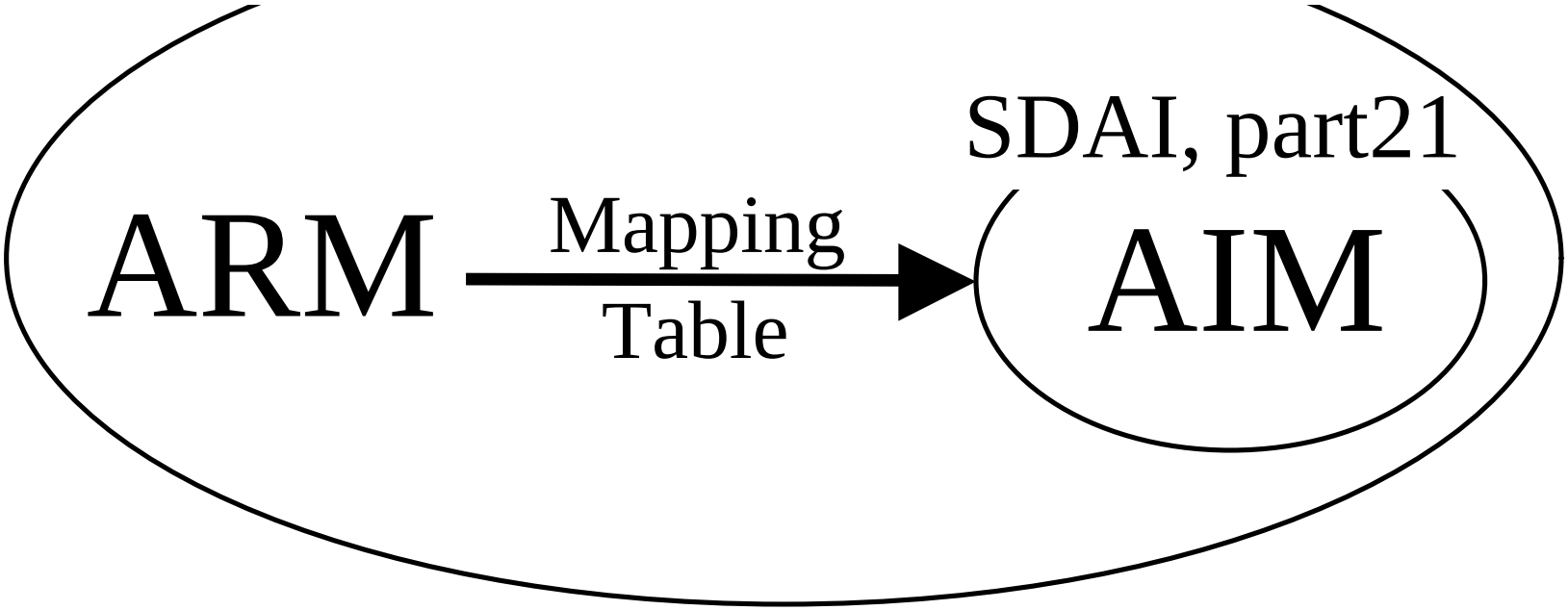
- Host SdaiRepositories for remote access by J-SDAI clients.
- Combination of SDAI server and HTTP Servelet
- Servelets are Java modules to run in a Java enabled web-server such as JavaServer™.
- Prototype running LINUX with ApacheJServ-1.1, domain "server.lksoft.de"
- Access control: user, groups, username, password
- Access Rights: Invisible, RO, RW


JSdaiServer - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Location: http://www.lksoft.de/jsdai-serv/ What's Related
Instant Message Internet Lookup New&Cool
JSdaiServer Administrator
Session
58A164D5
09205_249775_na.
19207_12346187-1
ExpressCompilerRej
3d-mid0.stp
model1
53711_75757f91-2
allied.203
ap.p21
box.stp
box_sphere.stp
box_sphere_hole.stp
Objekt1.stp
Repository "3d-mid0.stp" properties
Access rights
User
Default
Hiden
Read Write
Read Only
No Access
guestrw
guestro
guest
Groups
users
test
Commit changes
Reset
Document: Done


JSdaiServer - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Location: http://www.lksoft.de/jsdai-serv/ What's Related
Instant Message Internet Lookup New&Cool
JSdaiServer Administrator
Session
User
guest
guestro
guestrw
Group
test
users
Create new user
User name:
Password:
Default rights:
Read Write
Read Only
No Access
Commit Changes
Reset
Document: Done

Structure of STEP Application Protocols

Mapping Extensions of *J-SDAI*



Mapping extension

Mapping schema

- Extension of the SDAI_dictionary_data
- cover all information in Mapping Tables on a meta level
- MappingCompiler to convert Mapping Tables into a population of the mapping schema

Mapping operations

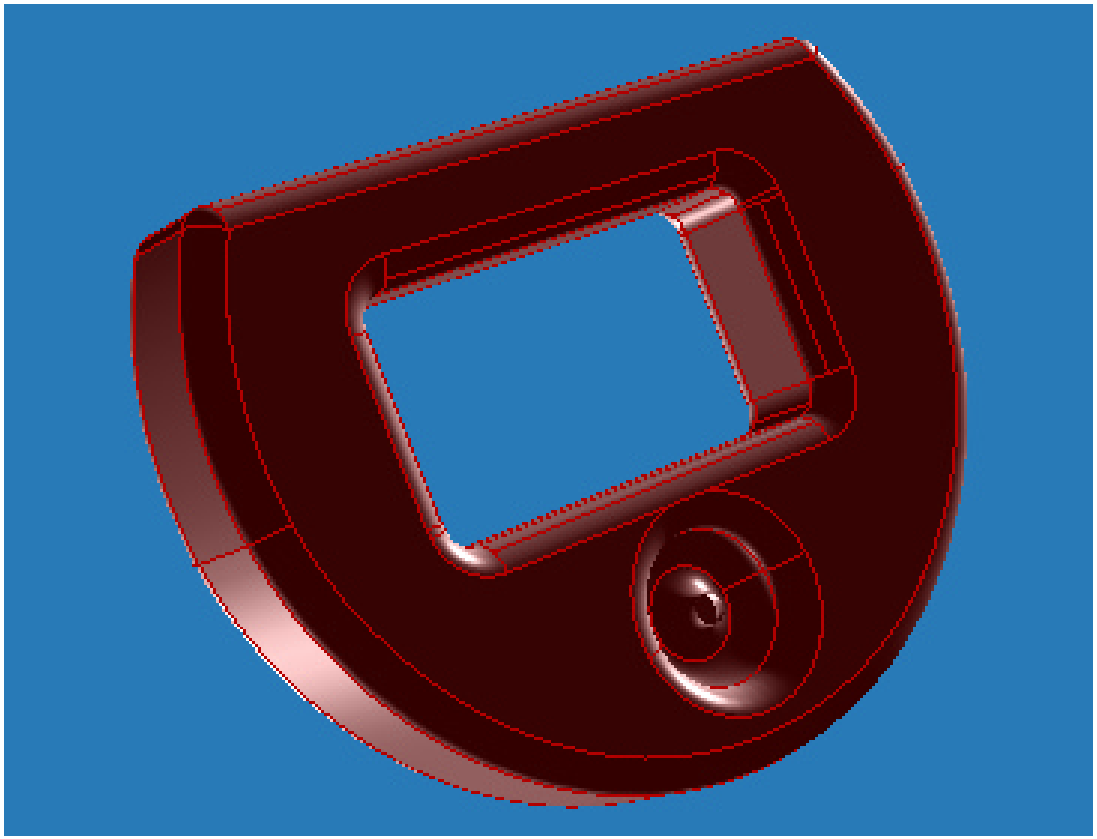
- Read and Write operating on AIM instances with ARM concepts

Resulting in a higher level API on top of SDAI

JavaBeans^{TM} => JSdaiBeans

- JavaBeans are reusable software components.
  They are characterized through methods for
  - accessing properties (get/set)
  - communication: Specialized **event** objects which are send out by **eventSources** and received by registered **evenListeners**
- Bigger JavaBeans can be build up from smaller JavaBeans, either by
  - manually coding or
  - by using specialized tools (BDK ...)
- Beans may be visible (windows) or invisible
- SdaiRepository and application entity instances can be seen as invisible data JavaBeans, basis for JSdaiBeans

3D-Viewer Bean

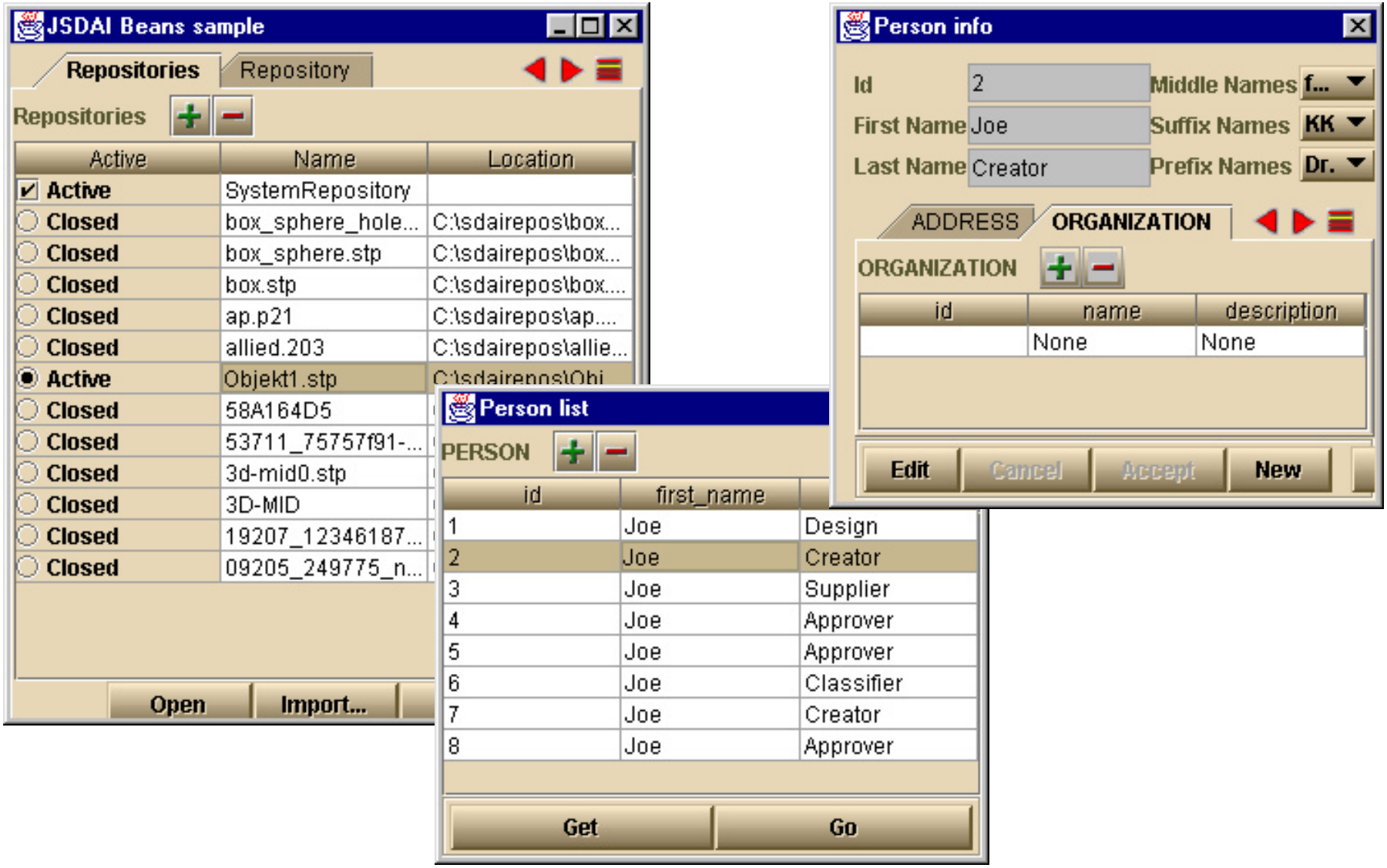


based on Java3D™ and IR42 (Geometry and topology)

3D-Viewer Bean

- Displays A-BREP, Faceted BREP, Wireframe and Surface shape_representation, mapped_item, but not CSG.
- Current properties with set/get methods:
  - shape_representation
  - display wireframe and/or surface mode
- Partly realized properties
  - transformation and scaling
  - picking of point/vertex, edge/curve and faces/surface
- Interactive control by standard mouse, alternatively 6 axis SpaceMouse (LogiCAD)

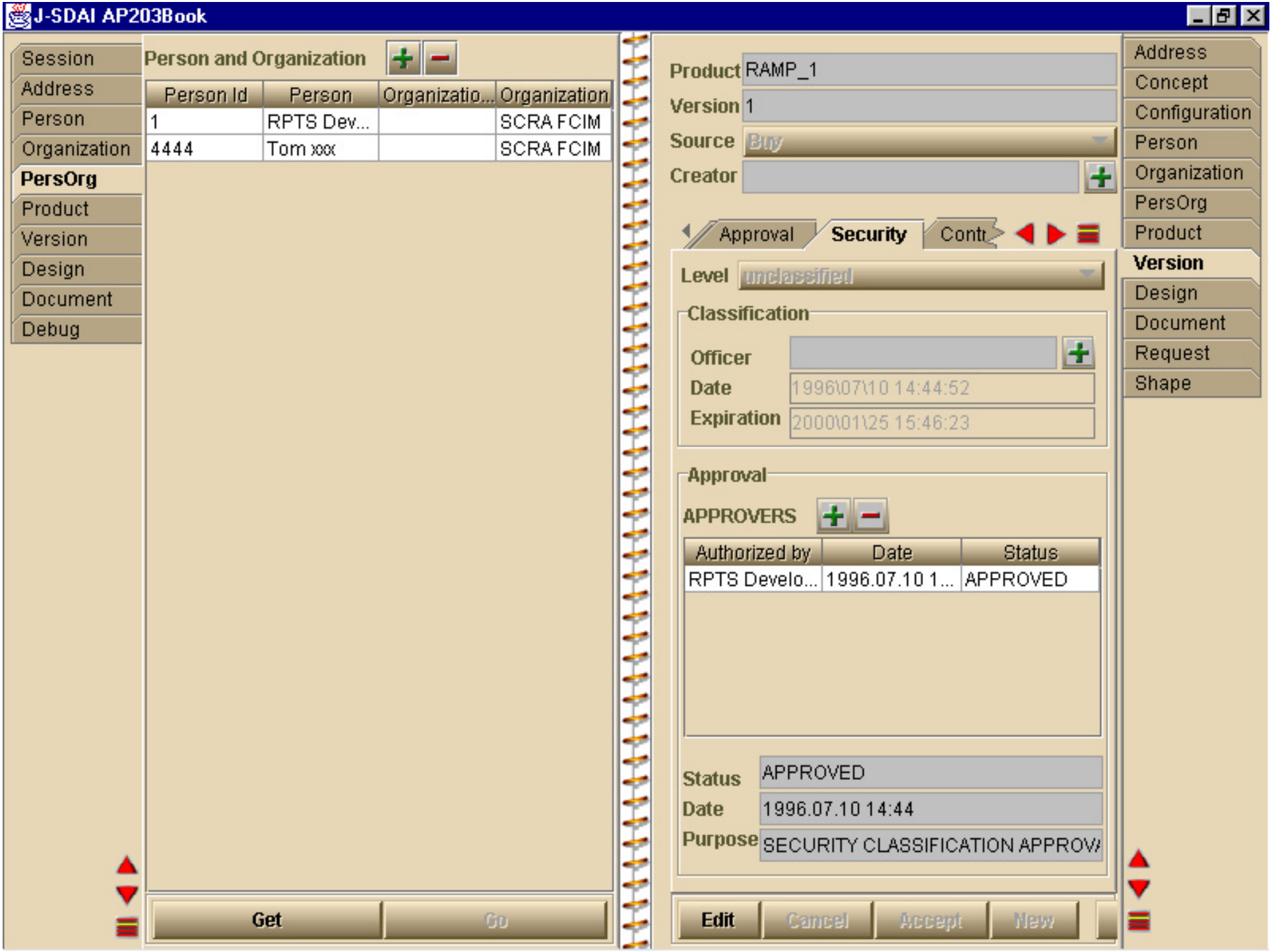
PDM-Beans


JSDAI Beans sample
Repositories
Repository
Repositories
Active
Name
Location
Active
SystemRepository
Closed
box_sphere_hole...
C:\sdairepos\box...
Closed
box_sphere.stp
C:\sdairepos\box...
Closed
box.stp
C:\sdairepos\box....
Closed
ap.p21
C:\sdairepos\ap....
Closed
allied.203
C:\sdairepos\allie...
Active
Objekt1.stp
Closed
58A164D5
Closed
53711_75757f91-...
Closed
3d-mid0.stp
Closed
3D-MID
Closed
19207_12346187...
Closed
09205_249775_n...
Open
Import...
Person list
PERSON
id
first_name
1
Joe
Design
2
Joe
Creator
3
Joe
Supplier
4
Joe
Approver
5
Joe
Approver
6
Joe
Classifier
7
Joe
Creator
8
Joe
Approver
Get
Go
Person info
Id
2
First Name
Joe
Last Name
Creator
Middle Names
f...
Suffix Names
KK
Prefix Names
Dr.
ADDRESS
ORGANIZATION
ORGANIZATION
id
name
description
None
None
Edit
Cancel
Accept
New

AP203Book

End user application to :

- display and manipulate all Configuration control information of AP203 (cc1)
- work on AP203 data in a user-friendly way. Translating of the model into a user interface
- Display of all geometry data (cc2 to 6)
- like all other J-SDAI applications this is completely written in Java
  - it is platform independent


J-SDAI AP203Book
Session
Address
Person
Organization
PersOrg
Product
Version
Design
Document
Debug
Person and Organization
Person Id
Person
Organizatio...
Organization
1
RPTS Dev...
SCRA FCIM
4444
Tom xxx
SCRA FCIM
Get
Go
Product
RAMP_1
Version
1
Source
Buy
Creator
Approval
Security
Cont
Level
unclassified
Classification
Officer
Date
1996\07\10 14:44:52
Expiration
2000\01\25 15:46:23
Approval
APPROVERS
Authorized by
Date
Status
RPTS Develo...
1996.07.10 1...
APPROVED
Status
APPROVED
Date
1996.07.10 14:44
Purpose
SECURITY CLASSIFICATION APPROV
Edit
Cancel
Accept
New
Address
Concept
Configuration
Person
Organization
PersOrg
Product
Version
Design
Document
Request
Shape

JMID-3D

MID = Molded Interconnect Device

LPKF Laser & Electronics AG

JMID-3D

Purpose: Driving an 8 axis LASER machine for producing non-planar PCBs on the inner surface of a plastic case.
- 5 mechanical axes
- 3 optical axes (scanner)

Input:

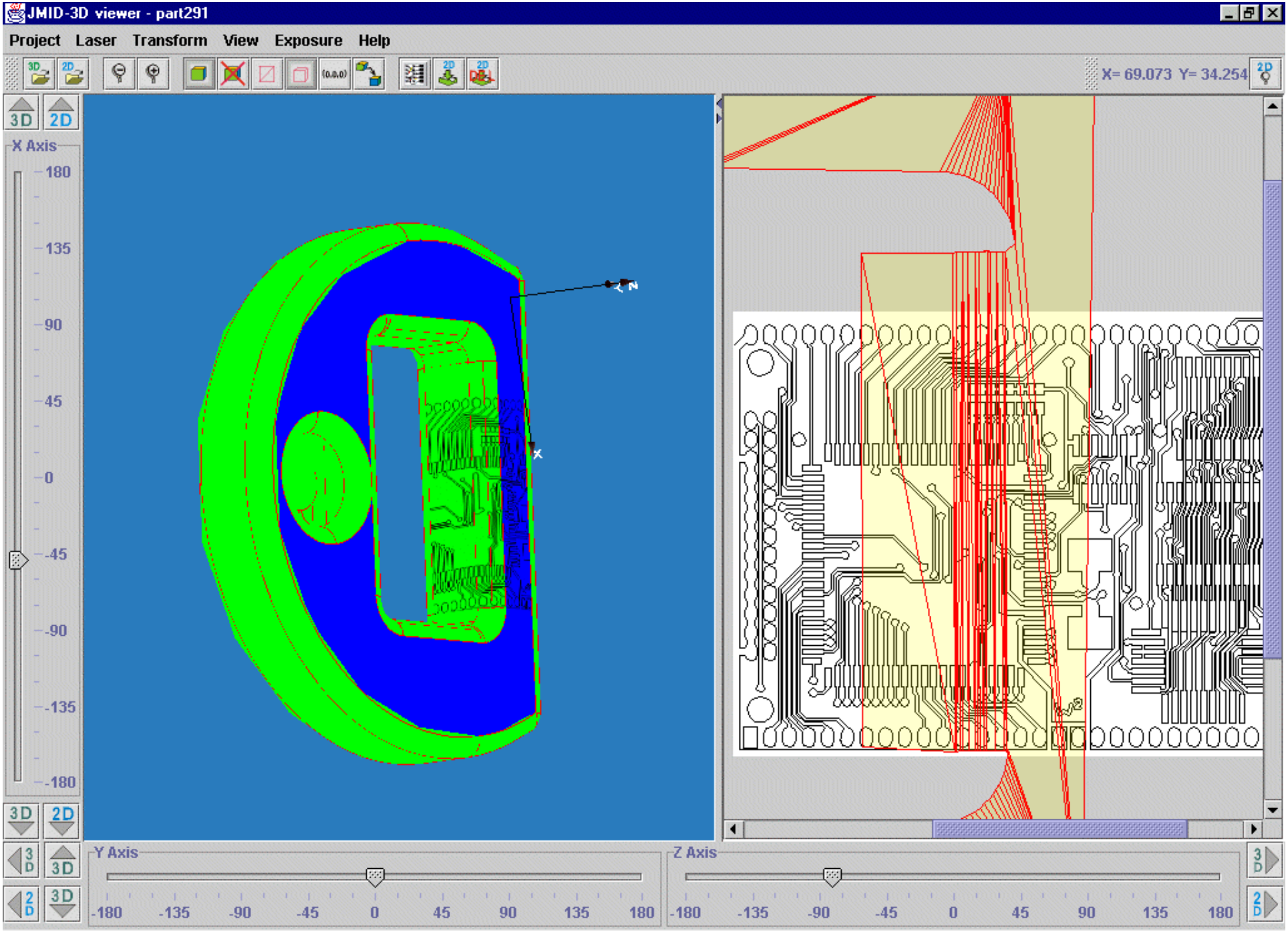
- AP203, A-BREP model
- 2D PCB data (CircuitCAM)

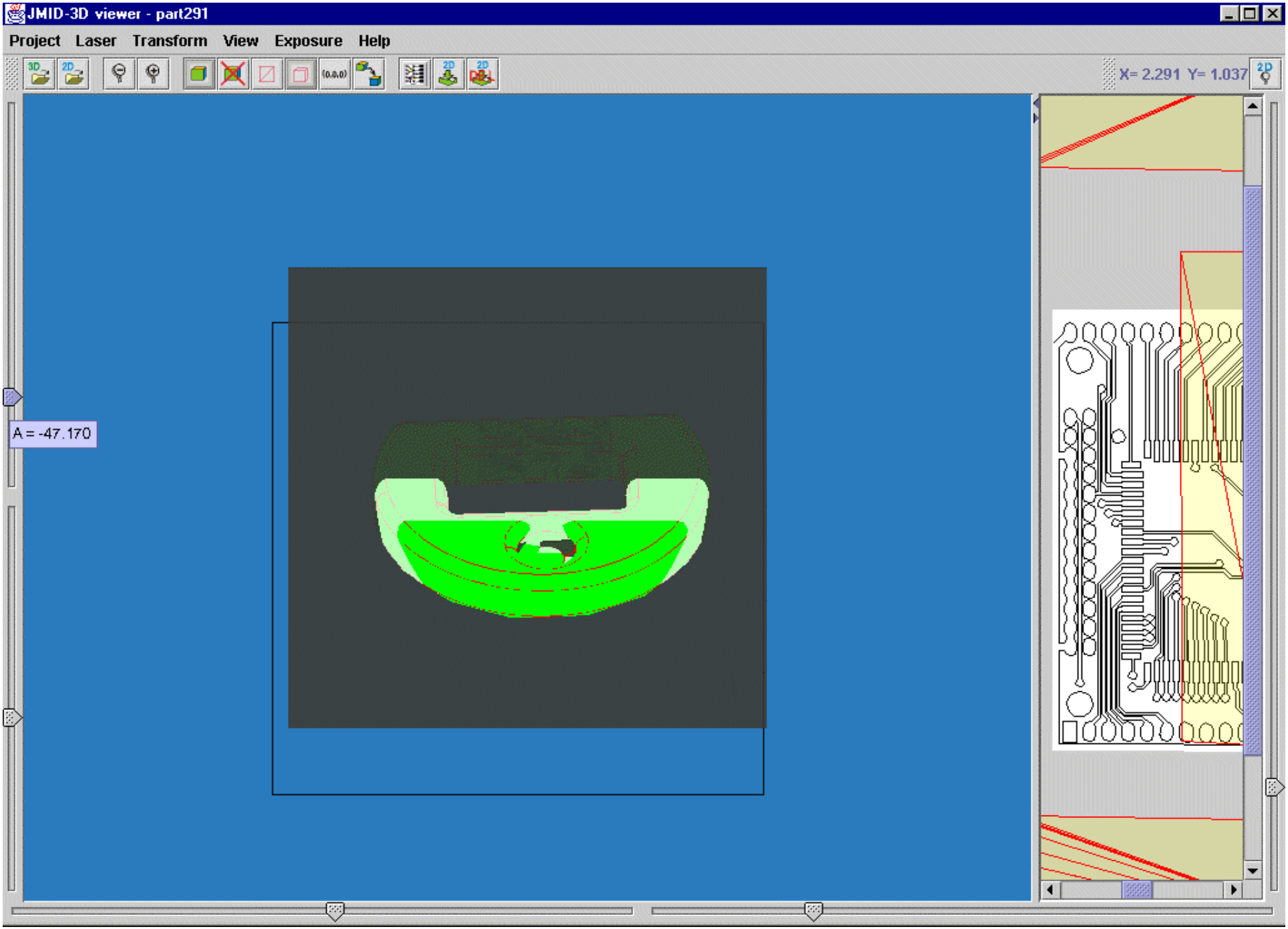
Operations

- Triangulation (Tessellation)
- Mapping of 2D layout to 3D surface
  control of distortions
- Define 3D working-areas for the LASER-scanner

Output

- 5 D + 3D machining data


JMID-3D viewer - part291
Project
Laser
Transform
View
Exposure
Help
X= 69.073 Y= 34.254
3D
2D
X Axis
180
135
90
45
0
-45
-90
-135
-180
Y Axis
-180
-135
-90
-45
0
45
90
135
180
Z Axis
-180
-135
-90
-45
0
45
90
135
180


JMID-3D viewer - part291
Project
Laser
Transform
View
Exposure
Help
X= 2.291 Y= 1.037
A = -47.170

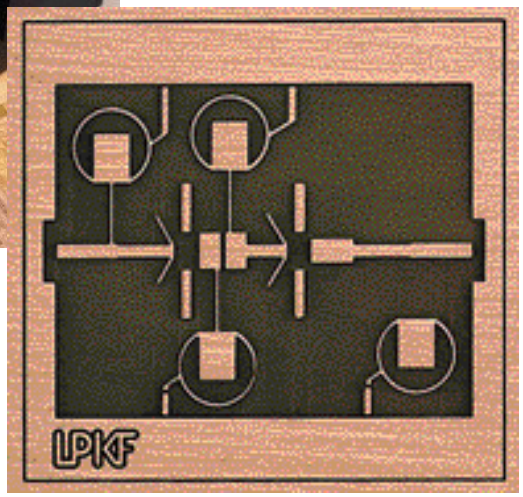
AP210Viewer

This prototype application has three main functions:

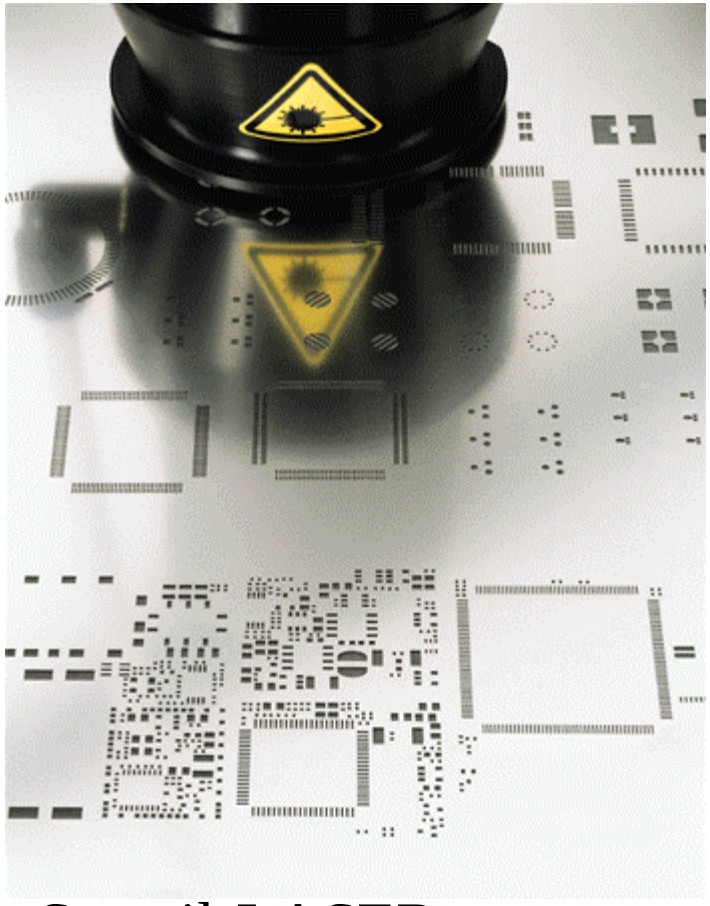
- Converter data from CircuitCAM / LPKF to AP210 (geometry only, no valid AP210 conformance class)
- display the AP210 data, 2D-PCB only
- generates CAM data from AP210 (GERBER format)

Basis for a possible CAM station in future when AP210 becomes more widely used

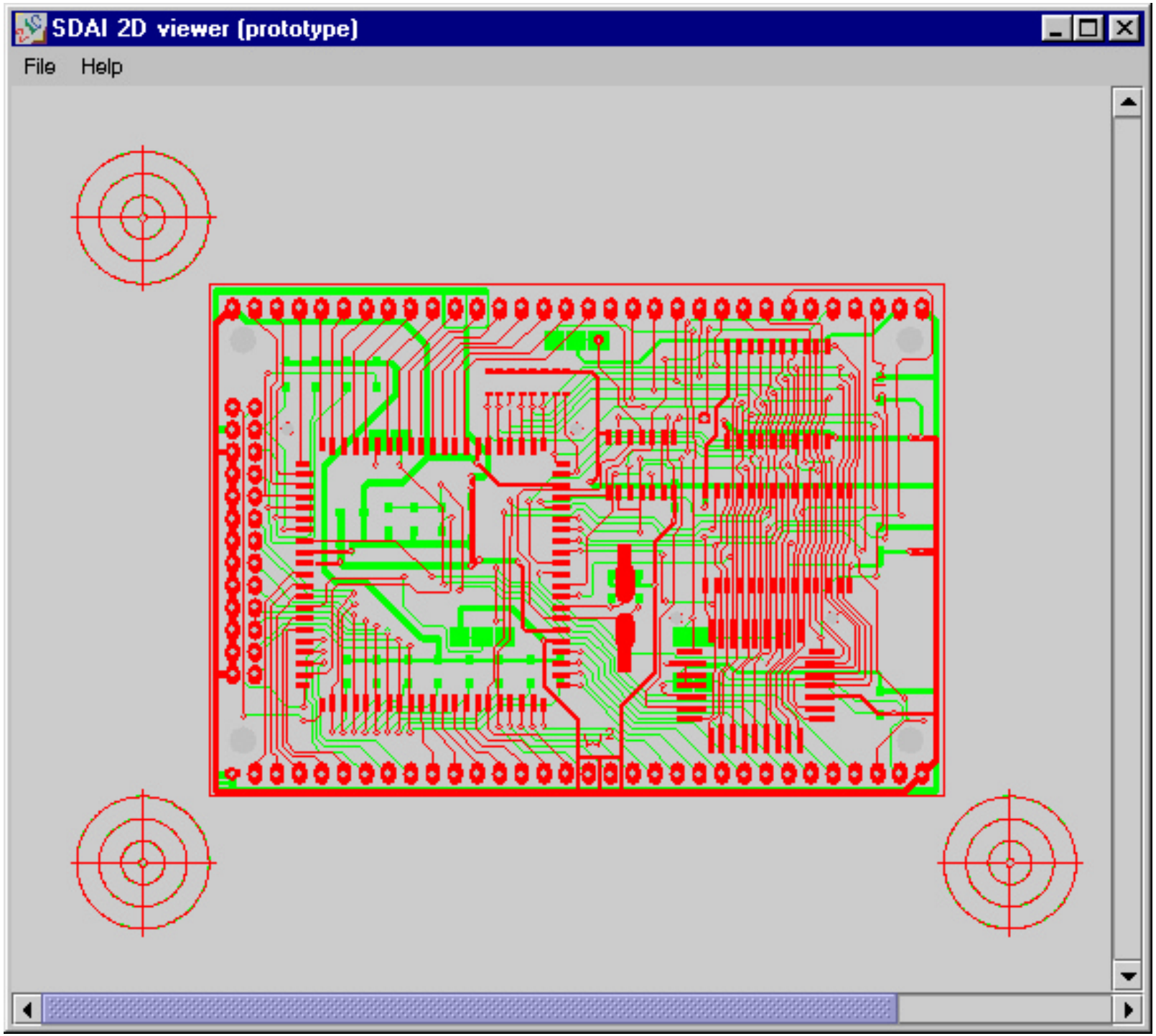
Data-source: CircuitCAM -> AP210



PCB-prototyping



Stencil-LASER


SDAI 2D viewer (prototype)
File
Help

J-SDAI Library

All schemas are included in their original EXPRESS short form. Till today STEP is using only the derived long form schema.

- file: ***jsdai_lib.jar*** (~8.5 MBytes)
- STEP IR-schemas: 49
- STEP AIC-schemas: 19
- STEP AP-AIM schemas: 9
- STEP AP-ARM schemas: 3 (210, 212, 214)
- STEP AP Mapping Information: 2 (210, 214)
- PLIB schemas: 2 (soon more)

This library will frequently be updated for new schemas